



Comparison between orthopedic and surgical treatment of mandibular condylar fractures.

An epidemiological and treatment outcomes research of the Maxillofacial Center in Cluj-Napoca, Romania

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Abstract

Background and aims. Condyle fractures are one of the most common traumas of the mandibular bone, but the treatment of these lesions lacks a standardized protocol. This study aimed to investigate the outcomes of orthopedic treatment by comparison with surgical treatment in a 10-year retrospective study.

Methods. We included condyle fracture patients treated in the Department of Oral and Maxillofacial Surgery of Cluj-Napoca County Hospital between 2015 and 2024.

Results. Young men were prone to suffer from mandibular condyle fractures, aggression being the most frequent cause. Usually, minor or moderate painkillers and amoxicillin are enough as medical treatment. There were no statistically significant differences between outcomes of orthopedic and surgical treatment in patients with condylar trauma without displacement.

Conclusion. The condylar fractures with no displacement or changes in the functionality of the mandible can be successfully treated by orthopedic reduction and intermaxillary fixation. The results of this study may help in choosing the optimal treatment based on the characteristics of the clinical cases.

Keywords: Condyle fracture, mandible fracture, head and neck trauma

Background and aims

Condyle fractures are the most common mandibular fractures. Some studies indicate that they represent from 25% to 35% of total lower jaw fractures [1,2], while others reported an even higher incidence (45%) [3]. The curve and horseshoe shape of the mandible, along with the reduced dimension of the condylar region, are the factors that favor fracture patterns in this mandibular area, regardless of the impact point of trauma. Road traffic accidents and accidental falls are the most common causes of condylar fracture, followed

by aggression [4–6]. Mandibular condyle fracture is prevalent in young adults, especially in male patients [1,4,7,8].

The treatment of the condylar region of the mandible is a continuous debate, due to the many factors that influence the healing of this anatomical region and the possible complications [9–12]. The treatment possibilities include either the closed treatment, which focuses on immobilization of the fracture segments using elastic or rigid closed reduction (orthopedic treatment), or the open treatment, where fracture segments are surgically identified, and

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internal fixation is performed (surgical treatment by osteosynthesis) [9,11,13–15]. On one side, there are some clear indications regarding functional and esthetic rehabilitation in severe trauma that advocate surgical treatment. For example, reduction of vertical height, malocclusion, severe displacement, esthetic changes, or failure of orthopedic treatment are some indications of open reduction and osteosynthesis [16–19]. Conversely, there are heterogeneous opinions on the treatment of the head of condyle fractures. The age of the patients, comminution, or dimensions of the fractured fragment, position of the fracture fragments, and the possibility of further temporomandibular ankylosis dictate the treatment decision [20–23].

Although both types of treatment (orthopedic and surgical) have shown satisfactory results when treating malocclusion, the surgical (open) treatment is considered superior regarding restoring parameters such as mouth opening dimension, mandibular lateral extrusion, and propulsion [6,15,24–27]. Even though both types of treatment have been perfected and practiced successfully nowadays, a consensus and a clear treatment protocol are missing [12,15,28–30]. Therefore, we aimed to highlight this topic by retrospectively analyzing the epidemiological data and treatment outcomes of patients from the Cluj-Napoca Maxillofacial Center.

Methods

We included patients with maxillofacial trauma, clinically and radiologically diagnosed with mandible condyle fracture (head of the condyle and subcondylar regions), with or without any other mandibular fractures, hospitalized for treatment in the Maxillofacial Department of Emergency County Hospital Cluj-Napoca between 2014 and 2024. All the patients signed the informed consent form and were treated orthopedically or surgically. We excluded patients with local infections or severe medical conditions that might interfere with bone healing (e.g., osteoporosis under Bisphosphonate treatment).

The patients' data were retrospectively gathered from the Cluj-Napoca County Hospital's informatics system (AtlasMed, GamaIT, Sibiu), including demographic, clinical, radiological, and treatment information, which were further anonymized. The subjects were divided into two groups. The first group of patients was orthopedically treated using intermaxillary fixation (IMF); the fracture was reduced and immobilized using two vestibular arch bar splints or IMF screws, fixed together with either elastic or rigid materials. The second group of patients was treated with open reduction and internal fixation using titanium mini plates and screws. The treatment decision depended on the type of condylar fracture associated with the severity of the signs and symptoms, being in accordance with existing trauma guidelines [16,17]. The patients

were also medically treated with antibiotics (amoxicillin or a combination of amoxicillin, metronidazole, and/or gentamicyn) and painkillers. The painkiller regimens were classified as minor (acetaminophen, metamizole, or ibuprofen), moderate (ketoprofen or ketorolac), and major (moderate regimen plus midazolam). Also, in some cases, dexamethasone was administered.

All the subjects were further questioned by phone regarding the treatment outcomes at least 6 months after treatment. Only 18 patients answered the questionnaire (Supplemental Table). The following parameters were assessed for both groups: occlusal restoration, mandibular dynamic function (lateral extrusion and propulsion, maximum mouth opening value, deviation during jaw opening), and pain level. The treatment efficacy was assessed based on the persistence or remission of the local signs and symptoms. For the signs, the after-treatment evolution was marked as complete, partial, or aggravated; for the symptoms, after the treatment, they were marked as improved, persisted, or aggravated.

Statistical analysis was performed by using Microsoft Office Excel and the online Statistics Kingdom 2017 software [31]. Mann-Whitney U test, Kruskal-Wallis, McNemar, Chi-square, and ANOVA tests were used to evaluate the statistical significance. A p-value under 0.05 was considered statistically significant.

This study was approved by the Ethics Committee of Iuliu Hațieganu University of Medicine and Pharmacy (No 76/06.03.2024), in accordance with the updated Declaration of Helsinki.

Results

A total of 68 patients were included in this study (Table I), with males (55 patients) being predominant (male-to-female ratio of 1:4.2). The patients were aged between 16 and 69 years old, with a mean and standard deviation of 33 ± 14 years old. A slight increase in patients living in urban places (54.4%) was found. Aggression was the most frequent etiology of condylar fracture (48.52%), followed by accidental falling (32.35%). Most patients (92.21%) consulted a Maxillofacial specialist within more than 6 hours after the trauma, with 39 of them being examined in the first 24 hours. Moreover, 7 patients were addressed to the doctor in more than a week after the trauma.

In 48 out of 68 patients, multiple lines of mandibular fractures were identified, including the condylar region (Table I). The subcondylar region was prone to fracture (92.64%) compared with the head of the condyle, with bilateral condylar involvement seen in 8 patients. Among these patients, 55 had various degrees of displacement (Table I). Even if the subcondylar region was prone to fracture ($p < 0.01$), the head of the condyle and subcondylar region had the same risk for displacements ($p > 0.05$). The head of the condyle was involved in the fracture during

aggressions (1 patient), bike accidents (2 patients), and falls (2 patients). Animal trauma (2 patients), motorcar accidents (5 patients), and sports accidents (2 patients) produced only subcondylar fractures. The patients with only condyle fractures without any other mandibular region involvement tend to wait longer to address to the doctor than those with multiple mandibular fractures ($p<0.001$). Patients with multiple mandibular fractures, including at least one condyle fracture, had more intense signs (e.g., severe trismus, dysphagia, etc) than those with only condylar fractures ($p<0.001$). However, there was no statistical significance between the intensity of symptoms and the type of fracture ($p=0.1$).

Eighteen patients answered our follow-up questionnaire (Table II). There were occlusal changes in 15 patients, 7 having trismus, the rest having trismus and significant edema. Pain was indicated by the majority of the patients (77.77%), followed by speech limitation (72.22%), with only 3 patients indicating dysphagia as a symptom.

Most patients were medically treated with moderate painkillers (50%) and amoxicillin (72.22%, Table II). An amoxicillin-only regimen was used in

isolated condyle fractures, and the association between Amoxicillin and other antibiotics (e.g., gentamicyn, metronidazole, etc.) was required when the condyle fracture was associated with other mandibular fractures (e.g., open fractures, $p<0.01$). Among the 18 patients who responded to the questionnaire, only one patient with a triple mandible fracture suffered from severe signs and symptoms, requiring treatment with major painkillers. This patient was further treated with open reduction and osteosynthesis. We used dexamethasone in 6 cases (out of 18), among which 5 patients were with multiple mandibular fractures, associated with severe local signs and symptoms ($p<0.01$).

Surgical treatment by open reduction and osteosynthesis was performed in 21 patients, among the others, elastic jaw immobilization being preferred (25 elastic IMF vs 22 rigid IMF, Table II). All the head of condyle traumas were treated by orthopedic measurements (4 elastic and 1 rigid IMF). Surgical management was selected for severe condylar displacement or dislocation, severe changes in occlusion, and aesthetic or functional concerns.

Table I. Epidemiology of condylar trauma patients.

Patients n=68			Statistical tests p*
	n=	n%	
Age (mean ± standard deviation years)	33±14	-	-
Etiology			
Aggression	33	48.52%	0.06
Falling	22	32.35%	
Sports accident	2	2.94%	
Animal encounter	2	2.94%	
Motorcar accidents	5	7.35%	
Bike	4	5.88%	
Place of living			
Urban	37	54.41%	0.46
Rural	31	45.58%	
Time of referral			
<6 h	6	8.82%	0.45
6-24 h	39	57.35%	
1-7 days	16	23.52%	
>7 days	7	10.29%	
Fracture sites			
subcondylar	63	92.64%	<0.01
condylar head	5	7.35%	
unilateral fracture	60	88.23%	<0.01
bilateral fracture	8	11.76%	
partial fracture without displacement	13	19.11%	<0.01
complete fracture with displacement	55	80.88%	

Observation.* Statistical analysis compares the frequencies between groups.

Table II. Treatment of condylar trauma patients.

	Patients		Statistical analysis for after treatment results (p)	
	n=	N%	Signs	Symptoms
Antibiotic treatment*				
Amoxicillin	13	72.22%	0.64	0.52
Amoxicillin, metronidazole, and/or gentamicin	5	27.77%		
Painkillers *				
Minor	8	44.44%	0.09	0.09
Moderate	9	50%		
Major	1	5.55%		
Dexamethasone*				
Yes	6	33.33%	0.66	0.39
No	12	66.66%		
Type of treatment				
Orthopedic (IMF)	47	69.11%	0.52*	0.64*
Elastic	25	36.76%		
Rigid	22	32.32%		
Surgical	21	30.88%		

Observations. *18 patients who answered the questionnaire.

We could obtain information about the feedback treatment from the 18 aforementioned patients who respected the follow-up protocol. All patients had favorable healing, except 2 who reported persistent symptoms (11%, $p=0.02$). Both patients presented with condylar fracture associated with other mandibular fractures, one treated with osteosynthesis of the condyle due to the condyle displacement, and the other with elastic IMF for a condyle fracture without displacement. Also, a mild persistence of signs (e.g., occlusal interferences, articular salt, etc) was seen in 9 patients (50% of patients). Using this treatment protocol, there was no statistical significance between osteosynthesis and orthopedic treatment regarding fracture healing and the persistence of the fracture signs ($p=0.52$) and symptoms ($p=0.64$).

Discussion

This study succeeded in indicating epidemiological information about Romanian patients suffering from maxillofacial trauma and comparing the orthopedic and surgical treatments of mandibular condyle fractures. Similar to the literature, most condylar traumas were observed in young male patients [1,4,5,7,32]. The etiology of condyle trauma varies in the literature; some of the research advocates road traffic accidents and accidental falls, while others indicate aggression [1,4–6,33]. However, it may depend on the demographic and geographical characteristics of the study [34]. In our research, the most frequent cause of mandible condyle fractures was aggression. The subcondylar region was the most common site for condylar area fracture, with only 11 % of patients having bilateral mandibular condyle fractures [3,35].

The delay in patients addressing medical care after mandibular trauma can interfere with the treatment outcomes. The bone healing can appear in a vicious position, and pseudoarthrosis or hypertrophic callus may develop. In these cases, a delayed treatment may be difficult and more aggressive. In our research, most patients saw a maxillofacial specialist in the first 24 hours. One cause of the delay can be represented by the treatment stratification in the emergency room, where the vital lesions have priority. For example, unconscious patients with brain trauma or bleeding lesions of internal organs are first treated for the vital emergency, with viscerocranium fractures waiting [36,37]. Five out of the 8 patients in our study who were addressed to the Maxillofacial Department for treatment in more than a week were treated first for life-threatening lesions.

There are various signs and symptoms that patients can complain about. Usually, mild symptoms, such as mild or moderate pain in the TMJ region or mild limitation of mandible opening, may be overlooked by patients and delay addressing to a specialist. We observed that the head of the condyle fracture patients waited longer before seeing a doctor. However, we cannot find any correlation between the intensity of symptoms and the fracture type. Pain and speech limitations were the most common patient complaints. This explains the efficacy of using minor and moderate painkillers for condylar traumas in our research, with only one patient requiring midazolam. In treating mandibular condyle fractures, analgesics are essential for managing pain, which can vary in intensity based on the injury’s severity. Minor painkillers, like acetaminophen, are often sufficient for mild pain and are commonly used

immediately after injury. Moderate analgesics, such as nonsteroidal anti-inflammatory drugs (NSAIDs), provide more potent pain relief and help reduce inflammation, making them suitable for moderate pain levels. For severe pain, major analgesics, including opioids like morphine, may be used for short durations, especially after surgery, but require careful monitoring to avoid dependency [3,38,39].

Dexamethasone is usually preferred in trauma that is associated with large edema [40,41]. Preoperative intravenous dexamethasone significantly reduced postoperative inflammation and its associated edema in bone surgeries. We used this corticosteroid treatment in one-third of the patients who presented multiple mandibular fractures with severe local signs and symptoms. Dexamethasone significantly treats mandibular condyle fractures by helping reduce inflammation, control pain, and minimize swelling around the injury site. This corticosteroid's anti-inflammatory effects aid in decreasing soft tissue edema, improving jaw mobility, and expediting healing. Additionally, dexamethasone can help prevent complications such as trismus and temporomandibular joint stiffness, which are common in condylar fractures. Its careful use as part of a comprehensive treatment plan enhances recovery and supports better functional outcomes in patients with these fractures [40,41].

The choice of antibiotic or antibiotic association was based on the type of fracture, signs and symptoms, time of referral, and treatment plan. Our preferred antibiotic was Amoxicillin. For 13 patients (72.22%) this was the only antibiotic administered during hospitalization due to the lack of open fracture sites. For the other 5 cases (27.77%) Amoxicillin was associated with other antibiotics such as Gentamicyn or Metronidazole to prevent infectious conditions. The antibiotic association was chosen only in

cases of a weakened general condition or with associated pathologies, or for those with a late time of referral.

The treatment of the condylar region is a continuous debate in the literature [42–47]. The protocols differ from hospital to hospital, but some clear indications impose the surgical treatment, such as reduced vertical height, malocclusion, severe displacement, esthetic changes, or failure of orthopedic treatment [16,17]. Conservative orthopedic treatment can be effective in the head of the condyle trauma, especially for mild signs and symptoms (e.g., mild pain, no asymmetry, no deficit of mandible movements, etc.) [48]. Also, subcondylar region fractures without displacement can be successfully treated by IMF [47]. Our study observed no difference between surgical osteosynthesis and orthopedic treatment in these cases. However, judicious and individualized treatment must be chosen.

Study particularities and limitations

The study included patients who were addressed a single institution, hence the limited number of subjects. Also, only 26% of the patients were compliant to the follow-up protocol and could be interviewed by the questionnaire.

Conclusions

Young male patients are prone to suffer from condylar region fractures. Subcondylar fractures are the most common site for condylar region fractures, aggression being the most frequent cause. The medical treatment usually requires minor or moderate painkillers and amoxicillin, except for the multiple mandibular open fractures in which an association of the antibiotic is needed. Orthopedic methods using intermaxillary fixation can successfully treat condylar fractures without displacement.

Supplemental Table

Patient questionnaire

Question	Answer (Yes/No)
Did you show up for your check-ups?	
Was your bite restored?	
If no, please detail	
Was your mandible's mobility restored?	
If no, please detail	
Did the pain of the trauma go away after treatment?	
Did you have speech limitations?	
Can you open your mouth as much as before the incident?	
Did you notice clicking or popping of the TMJ after the treatment?	
Did you have any other complains?	
If yes, please mention:	

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